

**AMENDMENTS TO THE CLAIMS:**

*This listing of claims will replace all prior versions, and listings, of claims in the application.*

**LISTING OF CLAIMS:**

Claim 1 (Currently Amended): A thin-film magnetic head comprising:

an inductive write head element including an upper core layer with a front end section magnetically coupling with an upper magnetic pole, a lower core layer with a front end section magnetically coupling with a lower magnetic pole, a coil conductor formed to pass between said upper core layer and said lower core layer, and ~~an~~ a coil insulation layer for sandwiching said coil conductor;

at least one thermal diffusion layer with a good thermal conductivity ~~formed on~~ in contact with said coil insulation layer at an outside region of said upper core layer, wherein no protection layer is present on the thermal diffusion layer; and

a thin coating film formed on said at least one thermal diffusion layer, only said thin coating film being formed on said at least one thermal diffusion layer, said thin coating film being made of a material selected from Ti, Cr, Ta, Ni, Fe, Co, Au, Pt, Rh and Ru, or an alloy containing at least Ti, Cr, Ta, Ni, Fe or Co.

Claim 2 (Original): The thin-film magnetic head as claimed in claim 1, wherein said at least one thermal diffusion layer is formed at a rear outside region of said upper core layer.

Claim 3 (Original): The thin-film magnetic head as claimed in claim 1, wherein said at least one thermal diffusion layer is formed at a lateral outside region of said upper core layer.

Claims 4 and 5 (Canceled)

Claim 6 (Original): The thin-film magnetic head as claimed in claim 1, wherein said at least one thermal diffusion layer is made of a material with a thermal conductivity higher than that of  $\text{Al}_2\text{O}_3$ .

Claim 7 (Original): The thin-film magnetic head as claimed in claim 1, wherein said at least one thermal diffusion layer is made of a material with a thermal expansion coefficient lower than that of  $\text{Al}_2\text{O}_3$ .

Claim 8 (Original): The thin-film magnetic head as claimed in claim 1, wherein said at least one thermal diffusion layer is made of a material selected from Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo, or an alloy containing at least one of Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo.

Claim 9 (Currently Amended): A thin-film magnetic head comprising:  
an inductive write head element including an upper core layer with a front end section magnetically coupling with an upper magnetic pole, a lower core layer with a front end section magnetically coupling with a lower magnetic pole, a coil conductor formed to pass between said upper core layer and said lower core layer, and ~~an~~ a coil insulation layer for sandwiching said coil conductor;

at least one thermal diffusion layer with a good thermal conductivity formed at an outside region of said upper core layer, said at least one thermal diffusion layer being in contact with a part of said coil conductor or constituting a part of said coil conductor, wherein no protection layer is present on the thermal diffusion layer; and

a thin coating film formed on said at least one thermal diffusion layer, only said thin coating film being formed on said at least one thermal diffusion layer, said thin coating film being made of a material selected from Ti, Cr, Ta, Ni, Fe, Co, Au, Pt, Rh and Ru, or an alloy containing at least Ti, Cr, Ta, Ni, Fe or Co.

Claims 10 and 11 (Canceled)

Claim 12 (Original): The thin-film magnetic head as claimed in claim 9, wherein said at least one thermal diffusion layer is made of a material with a thermal conductivity higher than that of  $\text{Al}_2\text{O}_3$ .

Claim 13 (Original): The thin-film magnetic head as claimed in claim 9, wherein said at least one thermal diffusion layer is made of a material with a thermal expansion coefficient lower than that of  $\text{Al}_2\text{O}_3$ .

Claim 14 (Original): The thin-film magnetic head as claimed in claim 9, wherein said at least one thermal diffusion layer is made of a material selected from Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo, or an alloy containing at least one of Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo.

Claim 15 (Withdrawn): A manufacturing method of a thin-film magnetic head comprising the steps of:

forming a lower core layer with a front end section magnetically coupling with a lower magnetic pole;

forming a first coil insulation layer at least on said lower core layer;

forming a coil conductor on said first coil insulation layer, having a pattern to pass on said lower core layer;

forming a second coil insulation layer on said coil conductor;

forming an upper core layer with a front end section magnetically coupling with an upper magnetic pole, on said second coil insulation layer; and

forming at least one thermal diffusion layer with a good thermal conductivity on said second coil insulation layer at an outside region of said upper core layer.

Claim 16 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said method further comprises a step of forming bumps on connection terminals to be connected with said coil conductor, and wherein said at least one thermal diffusion layer is formed in said step of forming the bumps.

Claim 17 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said method further comprises a step of forming under films for bumps formed on connection terminals to be connected with said coil conductor, and wherein said at least one thermal diffusion layer is formed in said step of forming the under films.

Claim 18 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said at least one thermal diffusion layer is formed at a rear outside region of said upper core layer.

Claim 19 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said at least one thermal diffusion layer is formed at a lateral outside region of said upper core layer.

Claim 20 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said method further comprises a step of forming only a thin coating film on said at least one thermal diffusion layer.

Claim 21 (Withdrawn): The manufacturing method as claimed in claim 20, wherein said coating film is made of a material selected from Ti, Cr, Ta, Ni, Fe, Co, Au, Pt, Rh and Ru, or an alloy containing at least Ti, Cr, Ta, Ni, Fe or Co.

Claim 22 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said at least one thermal diffusion layer is made of a material with a thermal conductivity higher than that of  $\text{Al}_2\text{O}_3$ .

Claim 23 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said at least one thermal diffusion layer is made of a material with a thermal expansion coefficient lower than that of  $\text{Al}_2\text{O}_3$ .

Claim 24 (Withdrawn): The manufacturing method as claimed in claim 15, wherein said at least one thermal diffusion layer is made of a material selected from Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo, or an alloy containing at least one of Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo.

Claim 25 (Withdrawn): A manufacturing method of a thin-film magnetic head comprising the steps of:

- forming a lower core layer with a front end section magnetically coupling with a lower magnetic pole;
- forming a first coil insulation layer at least on said lower core layer;
- forming a coil conductor on said first coil insulation layer, having a pattern to pass on said lower core layer;
- forming a second coil insulation layer on said coil conductor;
- forming a coil conductor on said second coil insulation layer, having a pattern to pass on said lower core layer;
- forming a third coil insulation layer on said coil conductor;
- forming an upper core layer with a front end section magnetically coupling with an upper magnetic pole, on said third coil insulation layer; and
- forming at least one thermal diffusion layer with a good thermal conductivity on said third coil insulation layer at an outside region of said upper core layer.

Claim 26 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said method further comprises a step of forming bumps on connection terminals to be

connected with said coil conductor, and wherein said at least one thermal diffusion layer is formed in said step of forming the bumps.

Claim 27 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said method further comprises a step of forming under films for bumps formed on connection terminals to be connected with said coil conductor, and wherein said at least one thermal diffusion layer is formed in said step of forming the under films.

Claim 28 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said at least one thermal diffusion layer is formed at a rear outside region of said upper core layer.

Claim 29 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said at least one thermal diffusion layer is formed at a lateral outside region of said upper core layer.

Claim 30 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said method further comprises a step of forming only a thin coating film on said at least one thermal diffusion layer.

Claim 31 (Withdrawn): The manufacturing method as claimed in claim 30, wherein said coating film is made of a material selected from Ti, Cr, Ta, Ni, Fe, Co, Au, Pt, Rh and Ru, or an alloy containing at least Ti, Cr, Ta, Ni, Fe or Co.

Claim 32 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said at least one thermal diffusion layer is made of a material with a thermal conductivity higher than that of  $\text{Al}_2\text{O}_3$ .

Claim 33 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said at least one thermal diffusion layer is made of a material with a thermal expansion coefficient lower than that of  $\text{Al}_2\text{O}_3$ .

Claim 34 (Withdrawn): The manufacturing method as claimed in claim 25, wherein said at least one thermal diffusion layer is made of a material selected from Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo, or an alloy containing at least one of Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo.

Claim 35 (Withdrawn): A manufacturing method of a thin-film magnetic head comprising the steps of:

forming a lower core layer with a front end section magnetically coupling with a lower magnetic pole;

forming a first coil insulation layer at least on said lower core layer;

forming a coil conductor on said first coil insulation layer, having a pattern to pass on said lower core layer;

forming a second coil insulation layer on said coil conductor; and

forming an upper core layer with a front end section magnetically coupling with an upper magnetic pole, on said second coil insulation layer,



said method further comprising a step of forming at least one thermal diffusion layer with a good thermal conductivity at an outside region of said upper core layer, said at least one thermal diffusion layer being in contact with a part of said coil conductor or constituting a part of said coil conductor.

Claim 36 (Withdrawn): The manufacturing method as claimed in claim 35, wherein said at least one thermal diffusion layer is formed in said step of forming the coil conductor.

Claim 37 (Withdrawn): The manufacturing method as claimed in claim 35, wherein said method further comprises a step of forming only a thin coating film on said at least one thermal diffusion layer.

Claim 38 (Withdrawn): The manufacturing method as claimed in claim 37, wherein said coating film is made of a material selected from Ti, Cr, Ta, Ni, Fe, Co, Au, Pt, Rh and Ru, or an alloy containing at least Ti, Cr, Ta, Ni, Fe or Co.

Claim 39 (Withdrawn): The manufacturing method as claimed in claim 35, wherein said at least one thermal diffusion layer is made of a material with a thermal conductivity higher than that of  $\text{Al}_2\text{O}_3$ .

Claim 40 (Withdrawn): The manufacturing method as claimed in claim 35, wherein said at least one thermal diffusion layer is made of a material with a thermal expansion coefficient lower than that of  $\text{Al}_2\text{O}_3$ .

Claim 41 (Withdrawn): The manufacturing method as claimed in claim 35, wherein said at least one thermal diffusion layer is made of a material selected from Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo, or an alloy containing at least one of Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo.

Claim 42 (Withdrawn): A manufacturing method of a thin-film magnetic head comprising the steps of:

- forming a lower core layer with a front end section magnetically coupling with a lower magnetic pole;

- forming a first coil insulation layer at least on said lower core layer;

- forming a coil conductor on said first coil insulation layer, having a pattern to pass on said lower core layer;

- forming a second coil insulation layer on said coil conductor;

- forming a coil conductor on said second coil insulation layer, having a pattern to pass on said lower core layer;

- forming a third coil insulation layer on said coil conductor; and

- forming an upper core layer with a front end section magnetically coupling with an upper magnetic pole, on said third coil insulation layer,

said method further comprising a step of forming at least one thermal diffusion layer with a good thermal conductivity, said at least one thermal diffusion layer being in contact with a part of said coil conductor or constituting a part of said coil conductor.

Claim 43 (Withdrawn): The manufacturing method as claimed in claim 42, wherein said at least one thermal diffusion layer is formed in said step of forming the coil conductor.

Claim 44 (Withdrawn): The manufacturing method as claimed in claim 42, wherein said method further comprises a step of forming only a thin coating film on said at least one thermal diffusion layer.

Claim 45 (Withdrawn): The manufacturing method as claimed in claim 44, wherein said coating film is made of a material selected from Ti, Cr, Ta, Ni, Fe, Co, Au, Pt, Rh and Ru, or an alloy containing at least Ti, Cr, Ta, Ni, Fe or Co.

Claim 46 (Withdrawn): The manufacturing method as claimed in claim 42, wherein said at least one thermal diffusion layer is made of a material with a thermal conductivity higher than that of  $\text{Al}_2\text{O}_3$ .

Claim 47 (Withdrawn): The manufacturing method as claimed in claim 42, wherein said at least one thermal diffusion layer is made of a material with a thermal expansion coefficient lower than that of  $\text{Al}_2\text{O}_3$ .

Claim 48 (Withdrawn): The manufacturing method as claimed in claim 42, wherein said at least one thermal diffusion layer is made of a material selected from Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo, or an alloy containing at least one of Au, Ag, Si, Zn, Al, Ir, Cd, Sb, W, Ta, Fe, Pb, Ni, Pt, Pd, Mg and Mo.